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Interface

Control

Documents

Volume 3

November 1976

Part 2
AMPS Payload to
Spacelab ICD

Atmospheric, Magnetospheric and Plasmas in Space (AMPS) Spacelab Payload Definition Study

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MARTIN MARIETTA

Bendix

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DR SE-02-A

Volume 3

Interface Control
Documents

November 1976

Part 2
AMPS Payload to
Spacelab ICD

**ATMOSPHERIC, MAGNETOSPHERIC
AND PLASMAS IN SPACE (AMPS)
SPACELAB PAYLOAD DEFINITION
STUDY**

Prepared for

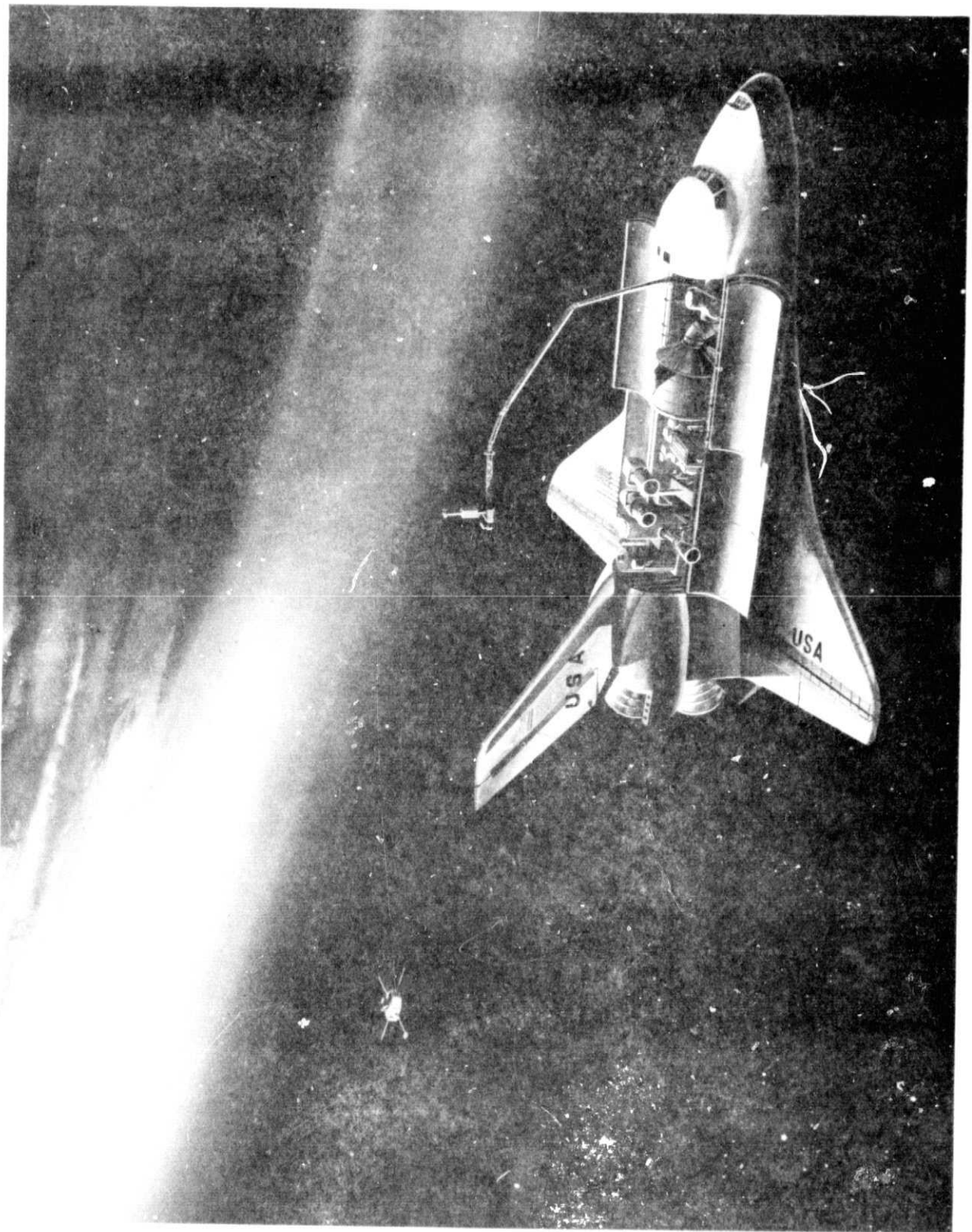
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Frontispiece

FOREWORD

The AMPS final report is submitted by Martin Marietta in accordance with Data Procurement Document Number 486, Revision A, of Goddard Space Flight Center Contract NAS8-31689.

The AMPS final report consists of seven volumes. They are:

Volume 1	DR MA-05-A	Executive Summary Report
Volume 2	DR SE-01-A	Mission Support Requirements Document
Volume 3	DR SE-02-A	Interface Control Documents
	Part 1	AMPS Payload to Shuttle ICD
	Part 2	AMPS Payload to Spacelab ICD
	Part 3	AMPS Payload to Instruments ICD
Volume 4	DR SE-03-A	Specifications
	Part 1	AMPS Program Specification
	Part 2	Labcraft Payload General Specification
	Part 3	Labcraft Instrument Systems General Specification
Volume 5	DR SE-04-A	Deleted per Paragraph I, Attachment A, Request for Proposal under Changes Clause, dated 8/31/76
Volume 6	DR SE-05-A	Instruments Functional Requirements Document
Volume 7	DR MA-04-A	Program Analysis and Planning for Phase C/D Document
Volume 8	DR MF 003R-A	Program Study Cost Estimates Document

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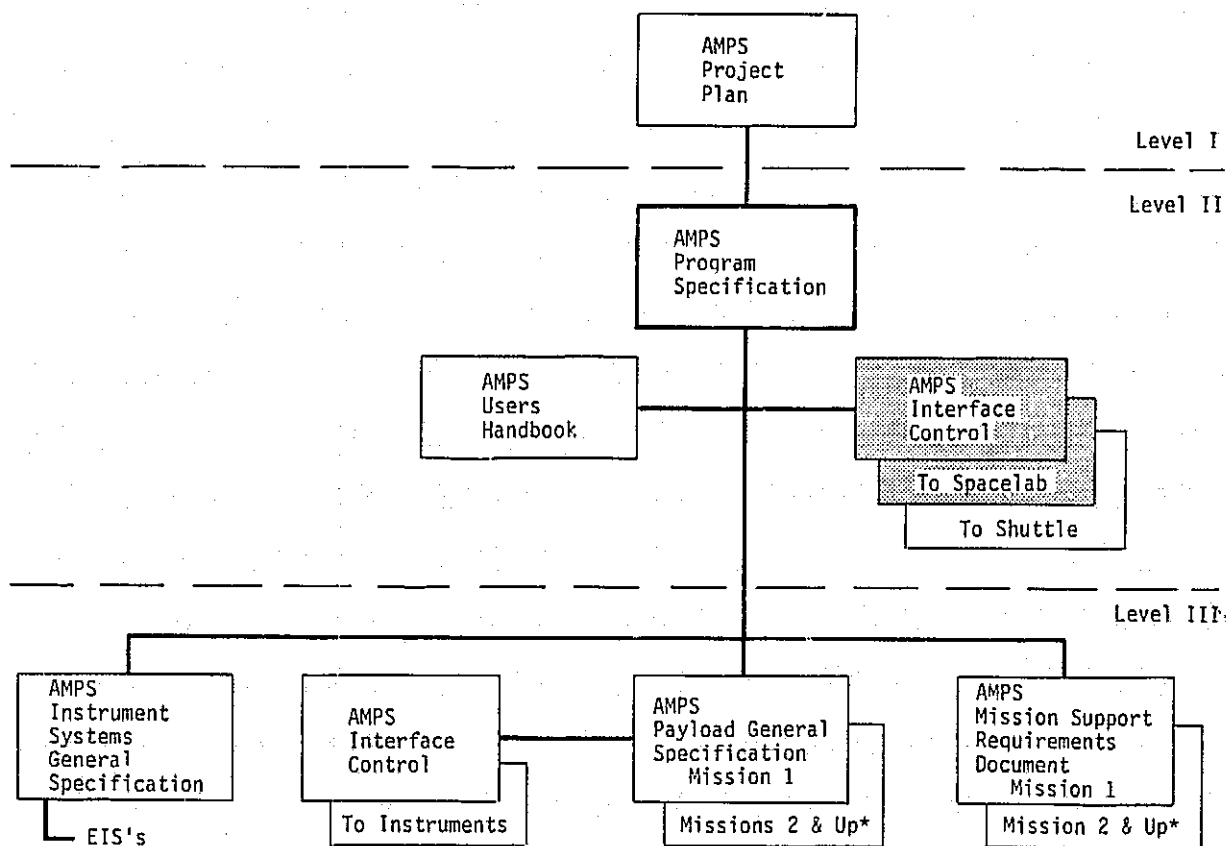
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1.0 PURPOSE

The AMPS to Spacelab Interface Control Document is a general document, which will be used as a guide for format and information content in generating specific AMPS Mission ICDs. This document is meant to supplement the Spacelab Payload Accommodations Handbook in that it will only define interfaces which are not discussed in the handbook to the level required for design purposes. It will not include interface information which is in the handbook, if added detail isn't necessary and if the AMPS requirements are within the allocations. Furthermore, payload interface data pertinent to AMPS and controlled by the Space Shuttle/Spacelab ICDs will control this payload and neither will it be repeated.

This cost effective approach to defining the AMPS to Spacelab interfaces will result in minimum documentation and will avoid redundancy with existing program documents.

Figure 1-1, the AMPS Top Level Requirements Tree, illustrates this ICD by a shaded area and its relationship to the other AMPS technical documents. Other interface documents shown in the figure are the Level II, AMPS to Space Shuttle Vehicle ICD and the Level III, AMPS to Instruments ICD.



* Reissue or Addenda, depending on magnitude of change.

Figure 1-1 AMPS Top Level Requirements Tree

2.0 SCOPE

This document will detail the physical, functional, and operational interface requirements of the AMPS to Spacelab.

2.1 APPLICABLE DOCUMENTS

Shuttle Vehicle/Spacelab Mechanical Interfaces (2/16/76),

ICD-2-5101

Shuttle Vehicle/Spacelab ECS/Thermal Interfaces (2/16/76),

ICD-2-5201

Shuttle Vehicle/Spacelab Avionics Interfaces (2/16/76),

ICD-2-5301

Shuttle Vehicle/Spacelab Software Interfaces (____),

ICD-2-5401

Spacelab Payload Accommodations Handbook (Preliminary Issue,

May 1976)

3.0 INTERFACE REQUIREMENTS

This section will detail the interface requirements of the AMPS Payload to the Spacelab. It will include interfaces required to satisfy prelaunch, launch, stowage, operations and return activities. Subsequent subsections of the document will differentiate allocations between the Spacelab Module and Pallets and will define tolerances, where applicable.

3.1 MECHANICAL/STRUCTURAL

3.1.1 AMPS ENVELOPE, LOCATION AND MOUNTING

This section will include a mechanical interface drawing detailing interfaces between Spacelab and AMPS to a sufficient level to be used as inputs to contractor detailed design drawings. The drawing will illustrate hardpoints, cable fittings and tiedowns, utilities

routing, cold plate interfaces, plumbing connections, deployed envelopes, thermal blankets, total instrument complement fields-of-view, etc.

Locations within the Spacelab where AMPS equipment may be located, their usage and capabilities will be in the Spacelab Module and on the pallets. Typical module locations and functions will be the AMPS C&D Panel mounted in the Spacelab Racks; the utility lines (power, signal and fluids) running from the subfloor connector bracket to the cable support brackets on the racks; the cooling air interface, illustrating an orifice size for inlet ducts and an outlet fitting to the Spacelab return ducts.

3.1.2 PAYLOAD WEIGHT, CENTER OF GRAVITY AND MOMENTS-OF-INERTIA

This section will comply with the Spacelab Payload Accommodations Handbook, paragraph 3.2.

3.1.3 AMPS ELECTRICAL CONNECTORS

The AMPS to Spacelab electrical connectors will be described here.

3.1.4 AMPS LOADING

Loads paths, both limit and ultimate loads will be included. Factors and safety for structural loading design will be included.

3.1.5 AMPS VENTING/PRESSURE CONTAINERS

AMPS instrumentation will be vented to be able to withstand the ascent and descent pressure changes. Where venting is not practical, because of the possibility of high voltage coronal discharge, out-gassing causing contamination, etc., vessels will be pressure tight.

3.1.6 MATERIAL SELECTION

AMPS materials will comply with NASA/ESA established approved materials lists, specified in the Spacelab Accommodations Handbook, Paragraph 7.10.

3.1.7 PLUMBING

This section will define any plumbing interfaces, such as the fitting and tube sizes where the AMPS interfaces with the Spacelab coolant loop.

3.1.8 CONTAMINATION/CLEANLINESS

This section will comply with Paragraph 7.11 of the Spacelab Accommodations Handbook.

3.1.9 EQUIPMENT STOWAGE

Any loose AMPS equipment will be stowed in the Spacelab equipment containers. Container provisions are described in the Spacelab Accommodations Handbook, Paragraph 3.4.

3.1.10 CABLING ROUTING

This section will describe any AMPS cable routing interfaces needed to support the illustrations in Section 3.1.1.

3.2 ELECTRICAL

This section will comply with the Electrical Power and Distribution Systems defined in the Spacelab Payload Accommodations Handbook, Paragraphs 4.2 and 7.4. Additional interface design parameters are listed below.

3.2.1 INTERFACE BLOCK DIAGRAM

This section will contain a schematic block diagram illustrating the main elements of the electrical interface.

3.2.2 INTERFACE WIRING DIAGRAM

This section will tabulate pin functions, circuit origination

and termination points, voltage levels, and load characteristics. Power, power return, signal, signal return and shielding lines will be listed.

3.3 THERMAL CONTROL SYSTEM INTERFACES

The Thermal Control System Interfaces will comply with the Spacelab Payload Accommodations Handbook, Paragraph 4.3. Further design interface requirements are listed below.

3.3.1 MODULE EQUIPMENT COOLING

3.3.1.1 CABIN AIR LOOP

This section will define thermal requirements for experiments stowed along the module center aisle, in the subfloor, by the optical window, etc.

3.3.1.2 AVIONICS AIR LOOP

This section will define the requirements for air cooling the AMPS C&D panels. It will cover equipment temperatures, air flow rates, the amount of power generated by the panels.

3.3.1.3 SMALL EXPERIMENT VENT ASSEMBLY

This vent is located on the feedthrough plate of the forward cone. Instruments interface by means of quick disconnect. This section will specify inlet temperatures, flow rates and the effluent.

3.3.2 PALLET EQUIPMENT THERMAL INTERFACES

3.3.2.1 EXPERIMENT HEAT EXCHANGER

This section will specify heat exchanger inlet and outlet temperatures, cooling liquid and plumbing thermal characteristics. (This heat exchanger is currently required by AMPS to support the LIDAR and will be pallet mounted and be in the freon loop.)

3.3.2.2 COLD PLATES

The cold plates used for instrument/subsystem cooling are pallet mounted and are in the freon loop. This section will describe the heat rejection characteristics of AMPS to each utilized cold plate.

3.3.2.3 PASSIVE THERMAL INTERFACES

This section will define power, temperatures coatings characteristics of AMPS/Spacelab passive thermal interfaces, such as thermal blankets and standoff insulators.

3.3.3 EGS/AMPS GROUND OPS INTERFACES

This section will describe ground purging of the pallet and Spacelab Module both prior to and following installation into the Orbiter.

3.4 NATURAL AND INDUCED ENVIRONMENTS

The natural and induced environments which the AMPS payload will be exposed to both preflight and on orbit are identified in Paragraphs 5 and 7.7 of the Spacelab Accommodations Handbook.

3.5 COMMAND/DATA MANAGEMENT

The command and data management interfaces will comply with the Spacelab Accommodations Handbook, Paragraph 4.4. Any further detail will be listed below.

3.5.1 DATA ACQUISITION AND CONTROL INTERFACES

3.5.1.1 REMOTE ACQUISITION UNIT (RAU)/DATA BUS

This section will describe the number of RAUs dedicated to AMPS, as well as their I/O capabilities.

3.5.1.2 HIGH RATE MULTIPLEXER/DIGITAL TAPE RECORDER

The high rate multiplexer shall be the focal point of all instrument data acquisition. It shall be capable of interleaving instrument data plus other corollary data essential for post flight analysis.

During periods of communication gap with the ground, the Spacelab shall provide the capability to record AMPS digital data. The recorder shall be capable of recording a maximum data rate 7.5 Mbps data for at least 60 minutes.

3.5.1.3 VIDEO INTERFACE

The Spacelab shall be capable of routing video signals from the aft pallet and center pallet to the Spacelab Module. This section will describe the video line characteristics, such as sync signal, voltages, video signal/noise ratio, impedance, signal grounds.

3.5.1.4 ANALOG SIGNAL INTERFACE

The Spacelab shall be capable of routing seven analog signals from the aft pallet and a multiplexed analog/digital signal from the center pallet to the Spacelab Module. Within the Spacelab Module, the analog lines shall terminate into AMPS provided analog processing equipment. This equipment shall be rack mounted and provide signal switching, data recording, frequency demodulation and signal processing capability.

The AMPS provided processing equipment shall also provide an FM multiplexed output within a 4.2 MHz bandwidth for transmission to ground.

3.5.1.5 MULTIPLEXER/DEMULTIPLEXER (MDM) INTERFACES

This paragraph will identify the signal interface requirements for instrument measurements that are required to be hardwired to the Orbiter MDM because of crew safety, activation/deactivation or caution and warning requirements.

3.6 CONTROLS AND DISPLAYS

This section will define the integrated AMPS C&D requirements as they interface with the Spacelab. Functional and operational interface requirements will be defined here.

3.6.1 FUNCTIONAL INTERFACES

This section will present a brief functional analysis of crew to Spacelab Keyboards/CRT and AMPS instruments.

3.6.2 SPACELAB COMPUTER INTERFACE

This section will define the interface of the AMPS C&D software to the Spacelab Computer.

3.7 ATTITUDE AND POINTING CONTROL SYSTEM

3.7.1 SOFTWARE INTERFACE

This section will define software interfaces of the pointing platforms to the Spacelab Computer.